# Quantum Vortex Pinning in a Dual-Species Bose-Einstein Condensate

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Superfluidity is an intriguing macroscopic quantum phenomenon wherein fluid flows without viscosity, and energy dissipation is instead facilitated by quantized vortices. First discovered in liquid helium, superfluidity can be found in a diverse range of systems from the core of neutron stars to dilute ultracold atomic gases, and many comparisons can be drawn to systems which display superconductivity [1]. Among these systems, ultracold atomic Bose-Einstein condensates (BECs) offer precise control of experimental parameters, reproducibility and the ability to image vortices *in-situ* [2]. This makes dilute gas superfluids an attractive platform on which to study the fundamental dynamics of superfluidity, in particular the role of vortex nucleation as a mechanism of energy dissipation. By deterministically creating and pinning these vortices in the bulk of a highly oblate BEC, it is possible to study the dynamics of their mutual interactions as well as their de-pinning from pinning potentials, and investigate the mechanisms by which superfluidity breaks down [3, 4]. This work will present progress towards an experimental apparatus which will probe vortex dynamics in a binary BEC of $^{87}$Rb and $^{41}$K, as well as the results of early simulations exploring the parameter space of vortex nucleation within the system.

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